SUPPLEMENT.

The Mining Journal,

RAILWAY AND COMMERCIAL GAZETTE:

FORMING A COMPLETE RECORD OF THE PROCEEDINGS OF ALL PUBLIC COMPANIES.

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DESCRIPTIONS OF REMARKABLE MINERAL VEINS.

BY PROFESSOR D. T. ANSTED, M.A., F.R.S., G.S.

[Read before the Geological Society—Feb. 24.]

1. San Fernando Copper Lode, Cuba.—The district in which these lodes are found consists of granites and syenites, passing into other porphyritic rocks, and partly covered with calcareous conglomerate and limestone. The granites are affected by systems of joints which heave each other, and by veins of felspar, occasionally containing silver. The mineral field occurs in calcareous porphyries, passing into true porphyries and into conglomerates. The copper lodes (which range east and west) occur in the altered porphyries, and consist of two groups, traced about a mile in length, the width of the lodes reaching 50 ft., and the width of the mineral ground half a mile. The underlie is small. The principal lode (the northern) has been opened on by eight pits, from whence have been taken upwards of 10,000 tons of rich copper from a depth nowhere exceeding 32 fms. Ore was seen at the bottom in one shaft, the lode being 35 ft. wide, including about 5 ft. of barren ground, and some mundic on the footwall.

2. Sykesville Copper Lodes, near Baltimore, U.S.—The country here is metamorphic rock, ranging north-north-east, south-south-west, and dipping east-south-east, at a high pitch. There are granites, gneiss, and mica slate, with magnesian rocks in the lodes. The lodes are nearly vertical, ranging parallel to the country, but dipping in the opposite direction. The veins at the top contain much magnetic oxide of iron, but below 10 fathoms this changed to pyrites, succeeded and accompanied by copper pyrites. The lode did not appear settled at the depth reached by the existing shafts. There were several points at which pits had been sunk, and some copper ore obtained. In all these the gossan had a tendency to pass into magnetic iron ore. A remarkable and very large group of lodes was observed at the "Point of Rocks," where the outcrop is hydrate of iron, worked as an iron ore to some extent.

3. Ducktown Copper Lodes, in East Tennessee, U.S.—The south-eastern corner of Tennessee, near North Carolina and Georgia, has a number of lodes, strongly indicated by a rich gossan, and yielding a peculiar and rich black ore, which attracted much attention from the American geologists. The country consists of altered Silurian schists, alternating with grits. All range parallel, the mountain range (north 30° east, south 30° west) dipping south-east at a high pitch. The talcose schists pass into garnet schists, and become steatitic. They are accompanied by numerous strings of quartz, not true veins, whose width varies from a few inches to 10 or 15 ft. wide, and which occasionally show a gossan, either of hydrous or magnetic oxide of iron, with spongy quartz. These veins are nearly parallel to the strike of the country, and dip south-east.

Besides the quartz veins, and within a small tract of six square miles, intersected by them, are four gossan lodes, large, but with limits well defined, and connected by quartz strings, besides being accompanied by solid veins of quartz on the foot, or hanging wall. These also dip south-east. The enclosing rocks are talcose and steatitic, and contain cyanite, epidote, and garnets.

The length of the gossan lodes varies from 600 yards to upwards of a mile, the breadth varying from a few yards up to 250 ft.—these dimensions having been proved by measuring the outcrop of the gossan. Wherever the gossans have been sunk through deposits of black ore, highly auriferous, they have been found at a small depth (from 6 to 90 feet). Below the black ore is hard dense quartzose veinstone, spotted with copper ore, which has been sunk upon to 18 fms. in some places, but hitherto with no satisfactory result, although fair indications of copper lodes of the ordinary kind have been found. The thickness of the black ore varies from a few inches to 18 ft., but where tolerably uniform averages 4 or 5 ft. Rich bunches are found occasionally.

The ore, as assayed by Mr. Henry, consists of—sulphur, 29·47; copper, 2·73; iron, 26·04; quartz, 8·60; oxygen and loss, 9·16. The yield, on an average of six samples, taken carefully from ore heaps from the different mines, averages 26·2 per cent. of copper.

Of the four lodes, the *Hiwassee* ranges north-east and south-west, dipping south-east about 15 in. in a fathom. The gossan is traced a mile and a half, the width averaging 30 ft., and the thickness of black ore 3 feet. It is continued by strings of quartz towards the south-west, and also by a kind of contra lode, which ultimately becomes the *Tennessee* lode. This lode is irregular and bunchy, but has yielded large deposits of rich black ore, and some red oxide. It has been traced as a gossan lode for about three-quarters of a mile, ranging north 20° east, and south 20° west.

The *Polk County* lode is nearly parallel to the Tennessee, and of about the same length, as determined by the outcrop. It is associated with several veins, but is the only one yet found productive. The breadth is from 30 to 40 ft., and the thickness of black ore averages 3 ft.

The *Isabella* lode is only 600 yards long, but as much as 80 yards wide, and generally contains about 3 ft. of the black ore. It ranges nearly parallel to the Hiwassee. It terminates abruptly, strings of quartz proceeding from the extremities, without much approach to parallelism with the productive lode.

The following are stated as the points of resemblance and difference on comparing these lodes with others:—1. They have distinct parallel walls, and range independently of the range of the country.—2. They contain veinstone, and show gossan.—3. They are limited in length and breadth, but apparently unlimited in depth.—4. They have parallel veins and branches.—5. They are inclined at a high pitch. On the other hand, they present the following differences:—1. They are generally parallel to the enclosing schists.—2. They agree with the country in dip as well as strike. 3. They contain within their walls portions of the country unaltered.—4. They show a mass of black rich copper ore between the gossan and veinstone entirely distinct from either, and mechanically separated.—5. The width and depth of the ore appear to bear some relation to the form of the surface.

In some of these points of difference there is an analogy with the auriferous veins of Virginia and North Carolina, but the fourth condition is peculiar. They are considered to be of the nature of stock-works or gap-veins, fissures, filled up at a more recent date than that at which the rocks around become perfectly metamorphosed. They may be connected below with rich bunches of yellow copper pyrites, obtainable only by mining operations of a more regular character than have yet been undertaken. Analogous deposits are believed to occur in Virginia about 100 miles to the north.

GEOLOGY.—Prof. Phillips delivered his fifth lecture at the Royal Institution on Saturday; he directed attention to the indications which organic remains of the lower class of animals afford of the relative ages of rocks in the geological series, and again noticed the opinion of many geologists, that the remains of animal organisation afford evidence of a successive order of creation; and, without expressing an opinion on the subject himself, Mr. Phillips stated the facts as discovered by geological investigations. The organic remains of animals found in the lower classes of rocks consist of three types—the radiated, the articulated, and the mollusca. The lowest form of animal life is that of sponges, which so closely border on vegetable life that they are claimed by botanists as belonging to the vegetable world. The organic remains of sponges, though thus placed the lowest in the scale, are not found in the lowest class of stratified rocks, and this fact taken alone would oppose the notion of progression; but Mr. Phillips did not at the same time mention that the destructible nature of sponges afford grounds for supposing that they might have abounded in the lower rocks, and that the traces of them were effaced by the igneous action to which they were exposed. Mr. Phillips then noticed the organisations peculiar to different strata, and showed how far different genera of animal life extended, some of them having an extensive range through a variety of rocks till they became extinct, and others again, appearing for the first time in the upper stratifications, and becoming also extinct before the tertiary period. The trilobite, which was a crustaceous animal, and found in what is called the Silurian series, or those rocks in which the first appearance of organic remains are found, was instanced as peculiar to that class, and sufficiently definite in its range to characterise the rock in which it is imbedded. The small nodules in Bath stone, which give it the name of roe stone, are composed of organic remains, round which a crust of calcareous matter has been formed. These, and other species of the same types of organisation, were arranged by Mr. Phillips in their various locations; and, by numerous drawings and specimens of their fossil remains, he pointed out distinctly their ranges and limitations in the stratified rocks, leaving for consideration in the next lecture the fossil remains of vertebrated animals that occur in the more recent strata.

GOVERNMENT SCHOOL OF MINES.

The lecture by Mr. Warington Smyth was on the Ventilation of Mines. He observed that this ought to be particularly attended to, as upon it, in a great measure, not only did the health of the men depend, but likewise their lives. Soon after works were commenced, and they were prosecuted to any depth, a stagnancy of the air would take place. At a certain distance underground the temperature would increase, and the air would become vitiated by the candles, the men's breath, and gunpowder. There were always chemical changes going on: sometimes there were emanations from the rock, and this was generally the case where the mines were subject to humidity. The mode of ventilation practised in collieries and metalliferous mines greatly differed, and persons who were accustomed to one sort of working would very often criticise the method practised in the other most unfairly. In metalliferous mines there was almost invariably a communication between the shafts and levels, and in general in an end there were not more than two men at work. In collieries the workings usually extended over a large area. There was a constant ebullition of gases, and in many cases a great decomposition of pyrites ensued. In order to carry out a proper system of ventilation, it was necessary that a mine manager should have a knowledge of both physics and chemistry. In dry places, at the bottom of shafts, the air was more condensed. In mines there were to be met with carbonic acid, carburetted hydrogen, sulphuretted hydrogen, and vapours of arsenic and mercury. They often encountered carbonic acid in wells. If there were 5 to 8 parts in 100 of this, the combustion of a light would be difficult; if there were 10 parts then a candle would go out, and it would not be fit for a man to live in. Sometimes they would find this stagnancy of air in old workings, especially where for a long period they had been left entirely unventilated. In one case he could mention, carbonic acid was evolved from the rock itself: this was at Pontgibaud, in the volcanic district of the Auvergne; and it would be impossible for the men to work there unless the mine was ventilated by powerful machinery. After an explosion, in many of the colliery districts in Staffordshire, the practice was to place the men who had suffered on the earth, with their mouths to the ground, and then filling them with good ale; and this by many colliers of the present day was thought a good remedy; for if the man did not drink the ale he was considered to be in a bad state. Sulphuretted hydrogen occurs but in few instances: it was said to be sometimes met with in South Wales, again in France, and at Mons. One part in 800 would kill a dog. The atmospheric air in some districts was noxious, and at the time of the equinoxes and the hot summer weather, the men would often be necessitated to leave their work. In many cases bad air was the result of the respiration of the men and horses, as well as the combustion of candles. In some of the mines, where the clay formation was prevalent, the air was bad. In many old workings the sulphate of magnesia could be discovered; at the Great St. George Mine, about 113 fathoms from the surface, in the levels, the sulphate of iron, and that of copper, could be distinctly traced. The ores of manganese that were worked were generally oxides, and the mines of that mineral in Germany were badly and insufficiently ventilated. There were several theories about explosions. Dr. Plat, in his *History of Staffordshire*, mentions one well known in Derbyshire and the northern districts; this was denominated the pea-blossom damp, because it generally prevailed when that useful esculent was in blossom. Another that he writes about is the "globe damp," which rises from the bottom of the pit, in the form of a ball, and has always an ascending tendency. In Belgium, they were aware that the miners were obliged to conform to legislative enactments, and there were but comparatively few accidents there. 1-7th to 1-14th carburetted hydrogen, mixed with atmospheric air, became explosive; 1-15th to 1-13th was not so, but if a candle were placed to it it would burn with a blue flame. A great quantity of gas evolved from numerous pores; in certain seams there were magazines of this, which sometimes at once burst out upon the miner. Blowers are in general met with near a fault, and the overlookers there should never allow the men to work without a lamp; in fact, there was a great necessity of always using safety-lamps. In our metalliferous mines, now that the levels were 7 ft. in height, instead of 4 and 5 ft., as had previously been the practice, the ventilation was much better; and by the means of air-boxes and air-pipes, a more equal temperature could be kept up throughout the year, and the danger in these workings was much less than in collieries.

BRISTOL MINING SCHOOL.

The lecture on Monday was given by Mr. Thomas Austin, C.E., "On Surveying, and Surveying Instruments." The lecturer observed, "that surveying was one of the most ancient of sciences; that it must have been applied in apportioning the lands of the Nile to their respective owners, and when Pharoah gave the possessors thereof food in exchange for their land, 1701, B. C. There were two ways of ascertaining the areas of material surfaces—1. By arithmetic; 2. By geometry. Surveying might also be divided into plane and trigonometrical; in the former, the principal instrument used was that for lineal measurement, the best of which was Gunter's chain; in the latter an instrument for determining the various kinds of angles was necessary. The plane table, commondial, and theodolite, had each been made use of, but the theodolite was evidently the best, as it was only by the use of such you could expect to attain to anything like accuracy. In commencing a surface survey, much depended on the judicious selection of a base line; this was to be as nearly in the centre of the district to be surveyed as possible, uniting the two most distant points, unless intervening hills, or other objects, rendered such impractiable. This being accomplished, the next step was to determine the direction of the main triangles on each side of the base line, care being taken to make them as nearly equilateral as might be practicable, as attention to this somewhat lessened the liability to error. It was not a little astonishing that in the 19 different ways of calculating the area of a triangle, we were liable to 19 errors, and in a four-sided figure to 52, &c.—the number of errors being thus increased for every additional side to the figure; this rendered the circumferentor, or dial, so disreputable for accurate surveying, as by it you could not expect to be less than 15′ in error for every angle measured. In the Ordnance Survey, in which he (the lecturer) had been engaged for several years, a 60-inch theodolite was used, to insure the greatest possible accuracy. The best kind of field-book was that in which the course of the main chain line was recorded in a middle column, commencing from the bottom of each page, and noting offsets, &c. On the right and left of this main column, as they were taken in the course of the survey, considerable advantage was to be derived from sketching in the survey-book objects of importance as they stood in relation to the main lines, such as rivers, mansions, churches, &c. He would advise the young surveyor to make a judicious selection from the various kinds of field-books, and not by any means to change after using the method of his choice, or he would be almost sure to find himself in considerable confusion and error.—[Mr. Austin's second lecture on this subject will apply more particularly to mine surveying.]

Original Correspondence.

COLLIERY EXPLOSION NEAR BARNSLEY.

Sir,—The graves have scarcely closed upon the 112 unfortunate victims which were immolated near Cardiff, before we are again apprised of 180 more poor fellows having been sacrificed on the altars of the same cruel and insatiable foe—incompetency and neglect. I cannot ascribe it to any other cause. The sacred affections of parents, children, and kindred of the poor colliers are torn asunder, in the twinkling of an eye, while on duty, to appease the ravenous appetite of that destructive element—fire-damp. It is quite true that the colliers may be taught—they may learn, indeed—what is good *to be* done, by the eloquent strains which echo from Jermyn-street; but be it remembered that the subtle carburetted hydrogen which is lodged in the murky caverns of South Wales and Yorkshire shows, in a manner the most painful and afflicting, the things that are *being done*. The lives of 180 men and boys at Lund Hill Colliery are sacrificed. Will not such dreadful calamities teach our senators wisdom? Will the explosive compound ever disturb the peaceful repose, or challenge the braggadocio of Jermyn-street? The sad experience of the collier responds, No. The geological and mining professors in London are taxing their genius to develope Nature's laws, and charm the ears of admiring students and disinterested listeners, while Government inspectors are carefully and anxiously investigating new rules and regulations in warm and comfortable offices; but, sad to relate, the destructive gases are slaying their unfortunate victims by hundreds in the furthest recesses of the coal mines. The deadly conflict is not in London, nor in the offices of the Government inspectors, but in the bords and levels of the pits; here it is that the battle rages. The real cause of this painful visitation of Providence will most likely be wrapped in mysterious silence, as no one remains to tell the sad tale of the explosion. One of the men who was examined on the inquest suggests the probability of a trap-door having been left open. The idea of nearly 200 valuable lives having been exposed to the tender mercies of a trap-door, guarded by a boy, will surely be revolting to the feelings of Christian legislators and honest shopkeepers of London; a class of men who would hesitate to trust as many Chinamen in such a perilous position, without the surveillance of an efficient police to ward off the nightly prowlings of the ticket-of-leave men, whose cunning is but a drop in the ocean when compared with the subtlety of those insidious foes, the explosive gases. The Government ought at once to institute an active and vigilant police in each fiery mine, to sound the alarm of the approaching foes, and not allow them to concentrate in such dangerous masses as to cause the fearful destruction which has taken place in Lund Hill Colliery.

Feb. 24. Coal Miner.

THE LUND HILL COLLIERY EXPLOSION, NEAR BARNSLEY.

TO THE RIGHT HON. SIR GEORGE GREY, SECRETARY OF STATE FOR THE HOME DEPARTMENT.

Sir George—Has had his attention called to another, and that the most fearful, colliery accident ever known to have occurred in England, by which about 180 human beings, in a few moments, have been hurried into the eternal world, let us hope, not without some preparation to meet that august Judge, who rewards every man according as his works have been. Dear creatures, their bereaved families need our heartfelt sympathy and aid to alleviate in some degree their deeply sorrowful, broken hearts, under this distressing overwhelming calamity. The sad catastrophe is over; no wisdom, no ingenuity, no power of mortals can bring back those deathless spirits that have left their mortal bodies in a dreary coal mine, to be consumed wholly, or in part, or identity so far destroyed, as to baffle their dearest relatives to ever more recognise them in this sublunary world.

Sir George, it shall be no part of my business in this letter to either justify or condemn any or all the parties concerned in the proprietorship or management of this colliery, as all facts relative to this matter, no doubt, will be patiently and fully enquired into by Her Majesty's inspectors, and the coroner, &c., who will have an inquisition on the bodies.

I will, however, address a few remarks on the manner of inspecting coal mines, which I do earnestly hope will meet with that attention from Her Majesty's Government, and more particularly from Sir George, which I think its vast importance demands. Without flattery, I will take it upon me to say that Sir George earned for himself a lasting honour, as well as achieved a great public good, in passing the late Colliery Act, for the purpose of obtaining a better or more efficient inspection of coal mines; but while admitting so much, I beg to remind Sir George that, in my opinion, which I think is fully borne out by facts, the great all-important object he had in view in passing the said Act—viz., the prevention of accidents in coal mines—has not, and cannot, in the nature of things, be attained by the present mode of inspecting coal mines.

I know not what particular or special instructions are given by Sir George to Her Majesty's inspectors in reference to their duties, but this I know, that very large important collieries have not as yet, nor indeed ever had, an inspector at them, though it is notorious that some of them generate a large quantity of fire-damp, whereby the lives and health of the miners, as well as the property of colliery owners, are greatly jeopardised. One great fact is apparent to every one—viz., it is observed that there is no lack of activity and diligence in Her Majesty's inspectors in ascertaining, so far as they can, the cause of colliery explosions *when the direful mischief is done.*

Sir George will remember that this was precisely the case in Wales where the late melancholy accident, so nearly allied to the one in question in the ruinous results, occurred. The Cymmer Pit, although known to be very dangerous, had not been inspected for some time, or, perhaps, that sore catastrophe might have been prevented.

I have no desire, and it is very far from my intention, to impeach the conduct of the inspector of this or other districts; by no means—their time may be fully engaged in the daily inspection of mines; but this I do say, if such be the case, that their time is so engaged that they cannot possibly attend to all the mines in their several districts, such fact ought to be made public, in justification of their conduct, and for the purpose of at once remedying such a monstrous evil, by the immediate appointment of additional inspectors, so that all the mines throughout England and Wales may have the benefit of the late Act of Parliament, become inspected, irregularities detected, pointed out, and remedied, by which alone we may have reason to hope these sad accidents will most certainly be lessened and prevented. Besides, Sir George will not fail to see that partial inspection is fraught with untold evils, ever increasing, and ultimately resulting in appalling calamities. May I be allowed to suggest to Sir George whether it would not be advisable to make the duties of inspectors of mines binding upon them, in a similar manner to that of birth and death registrars? By the Registration Act, it is incumbent upon every registrar that "he shall be authorised, and is hereby required, to inform himself

carefully of every birth and death which shall happen within his district.' Now, who does not know that every registrar has his appointed time to visit every part of his district once within six weeks, so that no part of his district may be overlooked or neglected. So I think, Sir George, in like manner ought the inspectors of coal mines (not, perhaps, so frequently) to visit periodically every coal mine within their district.

Understand me, Sir George, I do not mean to say, in using the word *periodically*, that they (the inspectors) should, on a *fixed day*, always known to colliery proprietors, managers, &c., visit the mines in their districts. No, by no means; this practice I conceive fraught with great evil, alike to masters and men, and, if carried out, would not remedy or correct many evils in mines that ultimately result in fearful explosions. My meaning, however, is that every inspector should, as ought to be done, visit and inspect, and report thereon to Her Majesty's Secretary of State annually, every coal mine, stating its actual condition, from personal inspection, within his district.

I know of no other plan as regards inspection, so likely to be efficient in putting a stop to these sad and fearful explosions in coal mines, as a proper class of inspectors, and all mines regularly inspected, and their actual condition reported from time to time to the Government and people of this country.—*Feb.* 21. THOMAS STEPHENSON.

P.S.—I believe the Lund Hill Colliery has not been personally interiorly inspected since 1854 by Her Majesty's Inspector.

AN IMPROVED DAVY LAMP.

SIR,—Another terrible colliery explosion has occurred. I hope you will grant me space in your columns to make a few remarks on the causes of and means of avoiding these frightful explosions of fire-damp. The safety of some coal mines is committed to ventilation alone. This appears to have been the case in the one at Barnsley; for we are told that the draught was so great, as to render it "impossible to carry a naked light along the main galleries;" whilst, on the other hand, "naked candles were used in some parts of the mine." Yet, in spite of this, the mine became filled with fire-damp. Ventilation alone is therefore fallacious as a safeguard. We have no other resource but the Davy lamp; but the common Davy is a most imperfect instrument. The gauze, with which the light is surrounded, tansmits at best but a feeble ray; and, after it has been a few hours in use, and has become foul with soot, the light is so dim as to be quite insufficient for the miner's purpose.

Hence the great repugnance which the miners entertain towards it; hence the many tricks they play with it, and the continual evasion of its use, and that is the fruitful cause of all these numerous accidents.

There is an improved Davy, constructed with a glass bull's-eye, but it has the disadvantage of throwing only a focal light, and, therefore, of confusing objects within and beyond its focal length. It is single, and so affords no security against the common miner's trick of lighting his pipe by sucking the flame through the gauze. It is expensive, costing 12s. 6d., and is not in general use.

I have had a lamp constructed which I believe calculated to avoid all these defects. It has been lately submitted to the Society of Arts, and was pronounced to be "no doubt safe enough," and to "give a fair light." These are the essential conditions. Some trifling defects of construction are pointed out, which can be easily remedied. It is of double gauze, with windows of mica, a substance which will not, like glass, crack under intense heat. It is protected by a frame and lock from being tampered with.

I have no intention whatever of seeking to derive any pecuniary advantage from the invention, but I shall be amply rewarded if it contribute to the great end of diminishing the dangers of coal mines. Its cost is 10s.; that of the common Davy 7s., and the common Davy can be altered into it. I shall be happy to furnish any one interested in the subject with the details of its construction. I shall very likely be told that there is nothing new in my lamp; that all these things have been thought of before, &c. But I care not for the merit of originality; my only object is to place in the hands of miners a safe lamp, and one which they will use. I trust you will aid me in this design. My lamp is now being tried in a coal mine in Derbyshire; but in a case in which delay is fraught with danger, I am unwilling to wait for the report from thence, feeling very confident myself that the essential conditions are attained in it.

Keyworth, Derby, Feb. 25. —— C. W. EDDY, M.B. Oxford,

MINING IN AMERICA—SOUTH CAROLINA.

SIR,—A few observations on the useful minerals of South Carolina may not be uninteresting to the mining community of England, and as this State is at present the field of my labours, I venture to offer a sketch.

South Carolina is very equally divided in her geognostic conformation, the eastern half being occupied by the tertiary formation, with a little of the cretaceous cropping out along some rivers, while the western contains rocks of the metamorphic kind, granites, and trappean and trachytic rocks. It is in the up-country only, therefore, that we have any reason to expect minerals of great value.

The metals hitherto found in this State are, gold, copper, lead, silver, manganese, bismuth, and iron.

Gold is found over a very extended area, and is frequently met with in quantities, capable of remunerating the miners richly; but owing to bad management and ignorance in the operators—although mines have been repeatedly opened—very few have been successful, and by far the majority have been losers. Gold mining has, in addition, very rarely proved remunerative at great depths in any part of the world; and as we are not blessed with deposits of any consequence, our gold mining must look forward to these great depths. Gold occurs with us in saccharoid quartz veins, which generally give out on striking hard ground, at an average depth of 50 or 60 feet, in crystalline quartz veins, which become copper veins in depth; in lenticular hornstone veins, and in beds of the slates, chiefly the talcose. The hornstone veins alone possess high promise of persistency. For fuller descriptions of the various modes of occurrence I beg to refer to my first annual report to our Legislature, now in the press, from which I shall be happy to see you extract any matter that may be calculated to interest your readers.

The Silver-lead is found as yet most prominently at a mine in Sparsenburgh district, where the vein, however, very distinctly shows that it will become a copper vein in depth, this metal coming in in greater quantity below. It may be, however, that, as at Andreasberg, there is a copper and a silver-lead lode in the same vein.

Bismuth occurs as the carbonate at the Brewer Gold Mine, Chesterfield.

Manganese has as yet been found in available quantity only in the Edgefield district.

Iron is produced in Union and York districts. The ores belong to the specular schist (siderocriste, fér oligiste micacée, Eisenglimmerschiefer), and the itabirite, and are closely associated with the itacolumite, causing thus an increased resemblance between our itacolumite region and that of the Brazils. (See these rocks in my report.)

The *Copper* is of all our metals probably the one which merits most attention, partly because it has been only very recently discovered in our State; partly on account of the remarkable rise in the price of that metal, which necessarily attaches greater interest to its occurrences.

The copper area in our State seems to extend over the whole breadth and width of the up-country, but, of course, mines which with our limited explorations can already prove themselves worthy of the necessary investments, are few in number.

Unfortunately, injudicious and unsuccessful gold mining enterprises have stamped all mining operations as highly precarious in the minds of our public. We have no old, productive, and well-managed mines with us to point at as examples; and the attention of the public is, in addition, too much occupied with the cotton or rice planting interest to care for aught else. Nevertheless, I am happy to have succeeded in organising a small company for the purpose of opening a copper mine in York district—the Mary Mine—which presents the very highest prospects of success, and most remarkably corresponds in its geognostic and petrographic conformation with the copper mines of Cornwall. The vein is a contact vein of the granite and mica slate, while a porphyritic dike, older than the vein, appears first, for a long distance, as footwall, and then shows itself again on the hanging side. Copper pyrites and native copper appear immediately under the surface in large quantities.

The company now in possession of this mine intend to procure a charter at the next session of the Legislature, and then to enlarge their number and their means. It is, perhaps, rather too bold to expect thus to lay the foundation to steady, progressive, and prosperous mining interest, and I much question whether our public will be willing to advance an enterprise of the kind on a large scale, and whether, therefore, we may not be obliged to look forward to European capital to raise our mining interest to the position which Nature would seem to have accorded to it. Such capital might be procured in the North, but the speculative spirit which has hitherto guided all northern mining companies is so little akin to legitimate and productive mining, that I, for one, am extremely anxious that South Carolina should not, like our sister state to the north, become the field of their speculations. Guided by this wish, I need scarcely add that if any of the readers of this communication take sufficient interest in the subject to induce them to demand further information, I shall be happy to enlighten them to the best of my ability.

The fee simple of mineral lands with us will generally range in the first purchase at from $10 to $25 per acre, and there is no special tax on mines none, indeed, except the ordinary land and property tax, which is slight.

Columbia, South Carolina, February 5. OSCAR M. LIEBER,
Geological, Mineralogical, and Agricultural Surveyor of South Carolina.

THE IRON QUESTION.

SIR,—In your last Journal, I find a review of Mr. Hall's work on the *Iron Question*, from your Staffordshire correspondent, and with your permission I will now trouble you with a few remarks on points omitted to be noticed, for want of my father's specifications of his patents, which I have forwarded for his future guidance. At page 38, Mr. Hall, with great truth and justice observes, "The puddling furnace already referred to is too important in the manufacture of iron to be slightly touched, and so dismissed in the manner in which it has been left. It is one of those subjects which require 'line upon line' in the discussion, and a practised hand in its treatment. In utility and economy, it is the *best apparatus* in the entire range of manipulation for producing iron of superior quality, when properly managed."

We are quite sure that Mr. Hall is not the man knowingly to lose sight of either truth or justice in describing his own merits, or condemning others; it is, therefore, to be regretted that, before he published his book, he did not purchase for a few pence, at the Office of the Commissioners of Patents, the printed specifications of Henry Cort's patents, in 1783 and 1784, in order that he might learn, "line by line," the true character of the puddling and boiling process, so clearly defined by the greatest of all inventors in iron making, 73 years ago. Instead of which Mr. Hall observes, at page 39, "It is true Mr. Cort had not the most distant claim to *merit* in the invention of *his* puddling process. Merit in the invention of the puddling furnace he had, but his *great merit*, and for this as a practical man he is above all praise, rests in the invention of the groove rolls, a claim meriting substantial reward, because including a principle which has never been, and it is doubtful whether it ever will be, superseded. Had the rolls and the furnace depended on the principle of puddling as at that time introduced, the name of Henry Cort, in the opinion of the writer, would not now have been known in the iron trade. He probably did as well as any one could do in that day, considering the manner of working and the materials employed—namely, 'dry pig boiling' upon a sand bottom furnace."

As regards "puddle boiling in the manufacture of iron," your correspondent states, "Mr. Hall's claim to the *merit* of that discovery is undoubted, and its importance is sufficiently attested by its universal adoption in the iron-works of this country, with the exception of those in Wales." Again, "Before this new process was adopted pig-iron was in the first place taken to a *refinery*, where it was submitted to a high degree of heat, produced by a *blast*. In this way, a large portion of the earthy matter which the pig-iron contained was separated from it, as well as a portion of the sulphur, phosphorous, &c. The plate iron, as it was then termed, was puddled in furnaces at a comparatively low degree of heat, the metal being only partially fused. This was termed *dry puddling*. By the present process, the *refinery* is altogether *discarded*, and the pig-iron is taken *at once* to the puddling furnace, where it is thoroughly melted, and raised to so high a temperature that it *bubbles like boiling water*. The iron is gathered into balls, as in the other process, the cinder remaining in a liquid state; the result is found to be that for nearly all purposes iron of a very superior quality is produced by this method than was previously obtained by the double process of *refinery* and dry puddling."

It appears that Mr. Hall only completed his apprenticeship in 1811, about 27 [years *after* Henry Cort's puddling patent in 1784, and in the very year that 40 of the principal iron firms resolved, at a general meeting of the iron trade of Great Britain, held at Gloucester, that they were greatly indebted to the late Henry Cort for his introduction of the puddling process (including the boiling process) to public attention, and for his invention of the grooved rolls, these firms including the names of Crawshay, Hall, and Bailey, J. and A. Hill, the Dowlais Company, and numerous Staffordshire firms, when the whole subscribed nearly 1000*l.* for the benefit of the widow of Henry Cort. Had Mr. Hall, after 46 years of additional experience, only possessed himself of all the requisite information, as before mentioned, he might have saved the expense of publishing his book on the *Iron Question*, except to show how closely his mind, as a practical man, followed out the working of Henry Cort's invention, as described and patented by the latter before Mr. Hall himself was born.

Cort's words are, in his patent of 1784, "For the preparing, manufacturing, and working of iron from the ore, as well as from sow and pig metal, and also from every other sort of cast-iron (together, with or without scull and cinder iron, and wrought-iron scraps). I make use of a reverberatory or air furnace, or furnaces, of dimensions suited to the quantity of work required to be done, the bottoms of which are laid hollow, or dished out, so as to contain the metal when in a fluid state. My furnace for the first part of the process being got up to a proper degree of heat by raw pit coals, or other fuel, the fluid metal is conveyed into the air furnace by means of ladles, or otherwise. When this air furnace is charged with sow or pig metal, or any other sort of cast-iron, the door, or doors, of the furnace should be closed till the metal is sufficiently fused, and when the workman discovers (through a hole which he opens occasionally) that the heat of the furnace had made a sufficient impression upon the metal, he opens a small aperture, or apertures, which I find is convenient to have provided in the bottom of the doors (but which is or are closely shut, as well as the doors at the first charge of the furnace with cold cast metal), and then the whole is worked and moved about through those apertures by means of iron bars and other instruments, fitly shaped, and that operation is continued in such manner as may be requisite during the remainder of the process. After the metal has been some time in a dissolved state, an *ebullition, effervescence*, or such like intestine motion takes place, during the continuance of which a bluish flame or vapour is emitted; and during the remainder of the process the operation is continued, as occasion may require, of raking, separating, stirring, and spreading the whole about in the furnace till it loses its fusibility, and is flourished and brought into nature; to produce which effect the operations subsequent to the fused state are the same, whether the fusion be made in the air furnace, or the metal be conveyed to it in a fused state, as first mentioned. As soon as the iron is sufficiently in nature, it is to be collected together in lumps, called loops, of sizes suited to the intended uses, and so drawn out of the door, or doors, of the furnace, when all the small pieces that may happen to remain are also cleared away. It has been found by me to be a good method of using such small pieces last mentioned, and also scull, or tinder iron, first broken into small pieces, and also all sorts of parings of iron plate, or other thin iron, and nut or bushel iron, commonly called wrought scraps, to throw them into the furnace in various proportions during the operation of bringing the fused metal into nature, and before it is collected into loops; and as the whole charge of the furnace is raked and stirred about, these scraps become lapped up in the loops after the fused metal is flourished and got into nature. The whole of the above *part* of my method and process of preparing and working iron is substituted instead of the use of the *finery*, and is my invention, and was never before used or put in practice by any other person or persons. The whole of which discovery and attainment (the puddling and boiling process) are produced by a more effectual application of fire and machinery, as described by me, than was before known or used by others, and are entirely new and contrary to all received opinions amongst persons conversant in the manufacture of iron; and the whole of my method may be completed *without* the necessity of using *finery*, cokes, chaffery, or hollow fire, and *without* requiring any *blast* of bellows or cylinders, or otherwise, nor the use of fluxes in any part of the process."

"Here, then," says the *Mechanics' Magazine*, "we have Cort the inventor, among other things, of the 'boiling process.' The description of this process is so graphic that no one acquainted ever so slightly with iron manufacturing can confound it with the puddling process. The words '*ebullition*' and '*effervescence*' cannot by any sophistry be made to refer to puddling refined metal. But Cort must be considered the inventor of the puddling also, for though the *refining* was considered an improvement on his original patented mode, the use of the *refinery* does not dispense with Cort's reverberatory furnaces. The *refinery* was merely an addition to Cort's invention, and its use in no wise detracts from his merit. Mr. Hall writes as if Cort's puddling had been supplanted by some new method, when, in fact, all that has been done has been in the way of carrying out Cort's original great discoveries."

Besides, Mr. Hall proves by his own practice, and that of all the other works now using the *boiling process*, without the refinery, that they are only doing in 1857 what my father did so successfully in 1785; that the Commissioners of the Navy, in advertising for tenders in 1789, declared they would use no British iron for naval purposes, that was not made in strict conformity to Cort's patent process.

Your correspondent in Staffordshire will have a very clear notion of my father's "*boiling process*" when he reads the words "*ebullition* and *effervescence*," and compares them with his own words, "*bubbles like boiling water*." Mr. Hall says the discovery cost him 3000*l.*, and if patented would have realised 1,000,000*l.*; yet he never did patent it. Was it because he found that Henry Cort's patent, in 1784, did include the *boiling process?* The whole of my father's inventions cost him 50,000*l.*, besides his ruin and premature death, through the villainy and defalcations of navy officials.

Mr. Hall, at page 9 of his preface, says, "It can be but right to 'render unto Cæsar the things that are Cæsar's'" and "'honour to whom honour is due." I have, therefore, had much pleasure in sending for his information the printed patent rights of my father's inventions, and in a few days I hope to forward, also, a printed abstract of all the patented specifications of every improvement in iron making for more than half a century previous to 1783, that he may learn whether any previous invention touched in any shape the originality of Henry Cort's discoveries in 1783-4.

Under these circumstances, Mr. Hall will, no doubt, as one of the best iron manufacturers in Staffordshire, and a gentleman of known integrity, be the first, Cæsar like, to give honour "to whom honour is due;" for having so undesignedly misunderstood my father's merits, his own ingenuity in the "*boiling process*" seems to have equalled the original invention, only now more than half a century behind it.

Among the fruits of these great discoveries 73 years ago, the number of puddling, boiling, balling, and heating furnaces, as patented by Henry Cort, now in use at the Bloomfield Works, may be nearly equal to one 82d part of the total number employed in Great Britain, the latter being 8200, according to Mr. Truran. The total quantity of puddled and rolled iron now made annually is at least 2,000,000 tons *more* than before my father's inventions, and the quantity annually exported 800,000 tons *more*. The total profit realised in Staffordshire and Shropshire from Henry Cort's inventions, during the last 66 years, is equal to 5,000,000*l.* sterling at least.

In the article on "Iron," by Mr. Fairbairn, in the *Encyclopædia Britannica*, he states—"It would be a difficult task to enumerate all the services rendered by Mr. Cort to the iron industry of this country, or sufficiently to express our sympathies with the descendants and relations of a man to whose mechanical inventions we owe so much of our national greatness." "Mr. Cort's inventions have conferred an amount of wealth upon the country equivalent to 600,000,000*l.*, and have given maintenance and employment to 600,000 of the working population of our land for the last three or four generations." RICHARD CORT.

Mining Journal Office, 26, *Fleet-street, Feb.* 25.

MINING PROSPERITY—No. I.

SIR,—In searching deeper and more comprehensively for one reason why mining is not more prosperous, I am reluctantly obliged to fall back on your Journal to substantiate a fact, which I will endeavour to point out in as short a manner as possible—viz., the absence of reports upon the working operations of several mining concerns, and also of the abstract of accounts, which are the usual index to the true state of a mine. Although, in a spirit of generosity and singleness of purpose, you devote large spaces in your Journal for each particular branch, yet I find but a poor return made to you for this act in furtherance of mining prosperity. I will, by your permission, refer to last Saturday's edition; on the last page, there appear nearly 500 different mining companies, marked at some price or other, and representing an almost fabulous amount of capital and expenditure; well, of this number, comprising dividend-paying and non-paying adventures, your readers, especially that portion of them who happen to be shareholders in many of these adventures, do expect to find at the proper place some report or statement relating to the 500 speculations, at stated periods—say, fortnightly for reports, and quarterly (not to be hard upon accountants) for the abstracted balance-sheets. But what is the case? An average of 120 reports weekly, being at the rate of one a month, supposing all to be reported regularly, but a careful examination exhibits a more wretched state of things; for instance, several mines are reported punctually every week, whilst others are reported perhaps once in three months. So much for mining reports. I now turn to mining accounts; taking 500 as the basis, at least the accounts of 40 concerns should be weekly exhibited of a quarterly audit, but reference proves 20 to be nearer the mark, thus showing that half-yearly meetings are the result of a Cost-book System, whose distinctive feature is bi-monthly settlements; and here again, as with the reports, averages are delusive; many have their two-monthly meetings as regularly as clock-work, whilst others, on the contrary, never have meetings or settlements, only at intervals of twelve months, or when committees of investigation compel them. For this wilful neglect in the management, I charge the shareholders themselves, because the appointment of all directors, pursers, managers, and secretaries is in their hands; they place them and can remove them, but how can you, Sir, expect officials to perform their duties efficiently when shareholders exhibit such apathy. The few meetings that are held are rarely attended by a quorum; some even have to be adjourned for want of a competent number to transact the business, and yet these very identical shareholders will fly for redress to you, forgetting their own responsibility in the matter. It is really discreditable to men of business to be such non-entities, and then complain to you of their shortcomings. There is a proportion who cannot, by reason of distance, attend every meeting, and this is the cause of their wishing reports and accounts to appear in your columns; true, these can be seen upon application at most of the offices, but this is inconvenient, and, therefore, on their behalf, I claim more punctual attention to this point at the hands of managers. Whether a concern is looking up or down it should be known, open to all; no close borough work, but, like our public funds, regularly and frequently reported; and sure I am, if capitalists could see the management of mining and other companies conducted upon this honest and straightforward principle, of openness and no secrecy, they would turn their attention to investment in this interest, and it would be well for the prosperity of mining, and enhance its importance gradually as the halo of respectability surrounded its management in a business-like, honourable, and prompt manner. In connection with this subject, it is satisfactory to direct shareholders to the conduct of the North Crofty meeting, reported in your last, which, with singular promptness, made a call for the balance of liabilities, without waiting for an accumulation of these interesting reminiscences to many who have felt the evil of not settling as they go on.—*Feb.* 24. CENSOR.

WHAT IS A WATER-GAUGE?

SIR,—You recorded in your Journal of last week the triumph of the Dowlais Iron Company, but I was extremely sorry to see that they were not allowed costs. The whole of the evidence was certainly more in favour of the defendants than otherwise, for even those who were so decidedly opposed to trusting to ordinary cocks, in cross examination admitted that they would not trust to either the glass tube or the float, and even Mr. W. Fairbairn considered the Dowlais arrangement safe; this is more than any witness—even for the prosecution—could say of any other water-gauge; and in my opinion proves that the annoyance and expense to which the Dowlais Company have been put arises from want of practical experience on the part of those in power. An explosion in Cornwall is almost unheard of, yet were a Cornishman shown the automaton contrivances for indicating the height of water in the boiler, I am confident he would say that he was disinclined to trust his life to such dangerous apparatus. From the whole evidence adduced at the interesting enquiry in Wales, it is evident that the cocks are not only a gauge, but a proper gauge, and the safest, when used alone, of any known. The only witness for the prosecution of any repute who preferred tubes without cocks, admitted that he should not consider a boiler to have a proper water-gauge if it had but one glass-tube—he would have at least two; this was no other if I recollect, than Mr. Longridge, the chief inspector to the Society for Preventing Steam Boiler Explosions at Manchester. Now, as the lives of large numbers of persons are almost at his mercy, I think that for the benefit of all engaged near, or connected with, steam-boilers, he should

explain why he recommends the use of an instrument which he admits cannot be depended upon alone, in preference to one which has proved itself to be so thoroughly safe in Cornwall, although working in a far more dangerous description of boiler than that in general use in Manchester.

I do not for a moment doubt that Mr. Longridge can satisfactorily solve this mystery; but under its present aspect it certainly appears an endeavour to assist the Government officer, and oppress those whose long practical experience had taught them that the lives of the men employed were in much less danger when the gauge-cocks were relied upon than when any pretended self-acting apparatus were used. The advocating of automatons for indicating the height of water in the boiler appears to me about as good as the invention which was some time since patented for preventing smoke, by employing an endless chain of fire-bars revolving upon cylinders, so that the incandescent fuel might be drawn to the back of the fire-box, and fresh fuel fed in at the front. Now, although this made a very pretty drawing, it was found not to answer nearly so well as the system of a large Liverpool house—that of giving their stokers a shilling a week extra when no smoke had been made.

To prevent boiler explosions, I would advise the employment of men as careful as the Cornish engineers, and the use of gauge-cocks only, properly placed. The Manchester society would thus find their annual number of explosions, and of boilers damaged from want of water, materially diminished.—*Liskeard, Feb.* 24. CORNISHMAN.

A GEOLOGICAL RÉSUMÉ.

"The man who has stood on the Acropolis,
And looked down over Attica; or he
Who has sailed where picturesque Constantinople is,
Or seen Timbuctoo; or hath taken tea
In small-eyed China's crockery-ware metropolis;
Or sat amidst the bricks of Nineveh,
May not think much of"—this controversy.

"Odi profanum vulgus, et arceo."

Having given to the author of the unique discovery "The agency or power that raised the clay-slates of Cornwall and Cardiganshire" "a Roland for an Oliver" in my letter, "Hammering it in," I anticipated his castigating reply in last Saturday's *Mining Journal*. I believe I am not in general an ill-tempered man, or one whose anger is commonly raised even by considerable causes, but I freely admit that his letter, published by you on Jan. 17, put me into a state of mind not at all flattering to my opinions regarding my equanimity of temper. In my first burst of rage, I exclaimed, bringing my teeth into a state of millstone grind, "What! class my mind, *en rapport*, with Sir H. Davy's, and enumerate me with such mighty geniuses as 'Shakspeare, Byron, Milton, Michael Angelo, and Cervantes!' Was there ever sarcasm so ill applied and so bitter; Roebuck could not equal it—irony so galling, satire so keen, or the whip which is put into honest hands to lash rascals naked through the world ever used with a more determined intent to 'hit on the raw!' Oh! 'tis terrible severity of the Disraeli stamp! and were it not for the evident anachronism, we might imagine the author of the libretto of *Don Giovanni* had my wrathful friend in his eye when he made Zerlina cry to her angered lover, '*Batti! batti!*'

Perhaps I was wrong in saying, in a former letter, that my "unpretending" friend was not conversant with the works of the wonderful men with whom he classed me. Why, Sir, if I were deserving of being so classed, it would, I feel, be a much higher honour than "holding a candle to the devil;" and really unpretending as I think I am, I should be vain enough to shout aloud the wisdom of Ecclesiasticus—"Let us praise famous men, and our fathers who begat us." Perhaps he is conversant with their mighty works: who knows but that he is one of those superior intelligences, with a low but extremely distinct, most sweet, and harmonious voice, such as Sir H. Davy described the *Genius* who accompanied him in his vision, and instructed him upon the works of the Greek masters; but it might more probably be that his lectures partake of their character. "If you attend to the sciences taught in them, you will find it vague, obscure, and full of erroneous notions, and instead of improvement, we shall find philosophy even applied to purposes of delusion, and the most sublime of the departments of human knowledge abused by impostors." But if it should be, as it sometimes happens, that he is one of those gigantic minds, possessing such extraordinary power as to rise superior to his order, and the age in which he is born—such as those

"——————who still rule
Our spirits from their urns."

I shall be the most ready to show him all due honour; for it is an axiom of my life, "Honour to whom honour is due." Perhaps he can stand in spirit with Gabriel, and see "horror plumed" in the crest of the fallen archangel—with *Childe Harold*, and watch the "ivy garland" waving in the night-breeze on the ruins of the mighty works of Vespasian—with melancholy misanthropic *Manfred*, will acknowledge his "barrenness of spirit," having ceased to justify his deeds unto himself, and knowing himself, might feel "What wants all this that it should Lethe be?"—or can accompany Cervantes' great hero in each adventure, as well as illustrate the part of his worthy attendant. It might be that Michael Angelo's achievements are ever present to his fancy, and that being a great connaisseur of high art, he can regard at pleasure the sublime outlines of the great fresco of the Vatican, and the sculptured proportions of the horned legislator of St. Pietro in Vincoli. Shakspeare's characters probably are his most intimate acquaintance, from that wonderful depiction of human frailty, King Lear, to Bully Bottom, whom, indeed, some ill-natured people might say he well represented after Puck's manipulation of that celebrated weaver; or others not much more amiable might compare him to Gratiano, who spoke "an infinite deal of nothing," and whose reasons were "as two grains of wheat hid in two bushels of chaff, and when you have them they are not worth the search."

It is curious to observe how in trifling circumstances one's character may be seen. Just remark that this "setter-up of strange doctrines," wishing in his ironical mood to class me with great men, selected for my compeers those whose genius lay in the power of imagination; and we might, indeed, in imitation of French juries, give to him the benefit of "extenuating circumstances," he, of course, anticipating that this species of talent would be regarded as the greatest of all, and most worthy of acceptation by *imaginative geologists*.

From the proof he has given of the extent and accuracy of his knowledge, I shall not be surprised if in his next letter this quoter of Dr. Johnson, the lexicographer, as an authority on geology, should rank "Stride" with Aurora Borealis, the great northern luminary; Aurora Australis, the southern luminary; Popocatipetl, the Mexican, of brilliant fame; and O'Ryan (vulgarly spelt Orion), the mighty Hibernian, of nasty birth, but sparkling career, and wondrous hydraulic performances. At the risk of all this, and possibly something more, "I wot not of;" I still venture upon a résumé of the points of our controversy, and will endeavour to remove the turbid envelope in which he conceals it. I can do so now with a clearer perception of his tactics, if I may so use the word; for whilst he acts the polecat in annoying an adversary, he reminds me, in his shirking, of the defensive resource of the cuttle-fish.

The first point, then, on which I joined issue with him was whether granite was a stratified rock, overlying clay-slate. He said that it was, and from his remarks (to use his own words) respecting "the superincumbent strata of the granite" I derived the correctness of that idea, maintaining that granite was not a stratified rock, although I knew that it has been found sometimes in *layers* above sedimentary strata, as, for instance, in the Valley of Irtysch, as well as in Saxony and other places not necessary to particularise. However, he did not allude to this rare phenomenon, for in his reply he simply stated that he did not mean to say that granite was a stratified rock, and referred to Johnson's Dictionary to show that the expression did not imply what it really did imply.

The next point was raised by his apparent assertion, that some hundred miles of granite would not oppose "any resistance" to subterranean forces,—thus, strange as it may appear, ignoring the mechanical entity of that rock, and regarding it—if I might use the expression—as a kind of physical vacuum. Here, again, I differed from him, and stated my belief that granite possessed very strong resisting powers. In answer to this he declared his readiness to discuss with me, at some future period, the different powers of resistance to "cleavage" possessed by different rocks; leaving untouched the point in question, and substituting new matter for discussion, and I in reply declared that the powers of cleavage were totally different from the force that raise igneous rocks and make "fissures" in the earth, and that as I did not know anything of the subject, I begged to decline the discussion. To myself, I confess astonishment at the unpoetic and irreverent manner the wonderfully mysterious powers of Nature are generally regarded even by some who are imbued with knowledge; and when such a man as 'Mister Battye' dares to talk about *his* discussing the subject of cleavage with me, as though 'twere matter on a par with pot-house politicians' learning, I stand aghast with astonishment; feeling, at the same time, that I am not keeping pace with the spirit of "The age of bronze."

"All is exploded, be it good or bad;
Reader! remember when thou wert a lad."

I know nothing of the powers of cleavage, and neither has my friend Mr. Evan Hopkins, in his very able work *On the Connection of Geology with Terrestrial Magnetism*, much improved my understanding the subject—probably no fault of his—but my crassness. As to the astonishing powers of cleavage, of which, as I have said before, "whatever they are, whether magnetic or, as some think, electric but not magnetic,—they carry on, as yet incomprehensibly to man, their vast and wonderful operations among the strata in silence and profound mystery, without disturbance." In endeavouring to penetrate the mystery I get into "wondrous mazes lost," and my mind travels to the Mosaical and sublime account of the creation. "In the beginning God created the heavens and the earth. And God said let there be light, and there was light. And the earth was without form and void, and darkness was upon the face of the deep." But there were then imperceptible agencies in full operation; the automatic functions of Nature were then at work, transfused within every integral portion, but so beautifully amalgamated as to remain imperceptible to observation, and, doubtless, with as much benignity of design in the Almighty Creator as is known in respect to the automatic functions which are made to perform their allotted part unconsciously to sensitive creatures. Let us ever bow down in sovereign awe before the supreme Majesty of heaven and earth, for His is the power.

My controversial friend has shown that he did not understand the technical meaning of the word "cleavage," which, geologically, is only applied to the divisional structure of slaty rocks, and mineralogically to the capability which crystals possess of reduction from secondary to the fundamental figures, when cut or chipped according to certain planes in their forms called the planes of cleavage. Again he consulted his dictionary, thinking, in his geological innocence, to find a word that was not used in the time of the great lexicographer, but failing in his research, and having discovered what *he believed to be the verb* from which the word is derived, he concluded he had found out the true meaning of *the new substantive*. Having with so much self-satisfaction, rehearsed one of the articles of his belief, it would be hard work, without the assistance of a force equal to that of a steam-hammer, to convince him, although we might say forces *cleft* their way through a rock, still the effect would be improperly expressed, geologically speaking, by the word "cleavage," which is applied to phenomena that are quite different in their origin. And here I would call his attention to the well-expressed ideas of Mr. Evan Hopkins, in the work I have referred to. He says, "The cleavage planes in all parts of the world are more or less vertical, and only slightly deviating from the meridian, thus exhibiting the influence of the polar force in the molecular arrangements of the crystalline semi-fluid base. As this active polar force is found diffused throughout all matter, acting chemically and mechanically, it must not only have an important influence on the elementary matter in the gaseous fluid, semi-fluid, and crystalline state, but also after consolidation, by acting through the pores, producing tension, and many mechanical disturbances." Now here, in this short extract, is a well-compressed quantity of matter to descant upon, and I could hardly extract from the work anything affording fuller scope for amplification.

Another theme of discussion was his allusion to lodes being formed from metals in a state of gas, and I demurred to the confident and *ex cathedrâ* manner in which he spoke of what is yet merely a matter of hypothesis, though supported by such men as Elie de Beaumont, Becquerel, Metscherlich, and others of equal authority; but their ideas are so seemingly different to his as to my mind to amount to this, that they simply entertain as hypothesis what an English lady long since elaborately maintained as an indisputable theory, sticking pretty closely throughout to the title of her book, *Electric Polarity the Universal Agent*, whilst I would defy anyone to say what my correspondent's own ideas are. [For a lucid epitome of M. Becquerel's hypothesis, or call it theory, refer to French correspondence of the *Mining Journal*, Jan. 3.] He rejoined to me (mark the argument), that unless oxygen gas was contained in black oxide of manganese oxygen could not be got out of it! Tremendous discovery, wonderful announcement! Let it be trumpeted forth to the four quarters of the earth, for the benefit of science. Startle not, ye chemists and geologists, at the discovery that oxygen is indeed contained in black oxide of manganese, and, *ergo*, black oxide of manganese contains oxygen. By establishing this astounding principle, he disposes of the question whether minerals in an aëriform state rise through the fissured crust of the globe. I halt, with panting heart to ask, Sir, which are we to admire most, the profundity of his knowledge, or the sagacity of his inferences. I fancy your exclamation to be, Well I never! Did you ever? Who'd have thought it?

He sets up Dr. Johnson to oppose my views of the proper geological use of the term "superincumbent;" the old dictionary seems to be his only support in our controversy, and, verily, among the great and unique discoveries he has made, not the least wonderful is his quoting Johnson as a geological authority. The truth is humiliating, but I will endeavour to bear it patiently. I now feel convinced that in vain have been the labours, wanderings, and sickenings, by sea and land, of those called geologists in the pursuit of my favourite science; they might have explored the wastes of Russia, searched the solitudes of the Alps, examined the stony features of America—aye, have drawn "a circle round about the world" in their investigations, but it is in vain, all in vain; there is nothing for it now but to burn "Silurias," "Principles," and all, as so much trash, and to seek geological knowledge from Johnson, as the *unum necessarium*.

I hope my friend will, in his next letter, endeavour to calmly review all the points in discussion, graciously complying at the same time with my request to reconsider his calculations as to the weight of the stone, said to be a cube of 15 feet, which caps the highest pyramid; and also the weight of a column of clay-slate 20,000 feet high, one yard square, for his own monument. Should he do so to my satisfaction, and humbly acknowledge his profound ignorance, I will tell him something about earthquakes. I will not attempt to teach him anything, for that would be as consistent as endeavouring to pommel a feather bed into a solid mass. Indeed I have yet to learn of him how he managed to "*hear shocks* of earthquakes, and traced their awful results to an issue of flame, to gas, to volcanoes, in the line of their direction, at an angle more or less at right angles with the electric currents." JAMES STRIDE.

Feb. 12.

"HAMMERING IT IN"—MR. STRIDE AND MR. BATTYE.

SIR,—The discrepancy in Mr. Stride's proceedings with reference to his motto, "Hammering it in," seems to be that he is never able to hit the nail on the head, while the writers in *Household Words*, whom he is so anxious to imitate—and not unnaturally so, since he is going to become a great author himself—seldom fail to deliver the blow effectively. Mr. Stride's *hammering* is like the trunk-makers', who proverbially are said to produce little work but great noise. His appears to be a mimicking genius, like that of the monkeys, who are fond of imitating the actions of men, or of the parrot, which, getting hold of a number of words, strings them somehow, but not very systematically, together.

I beg Mr. Stride's pardon for alluding to the quadrumanous class, for although he affects to disdain our notions of grammar, chemistry, and geology, and contemptuously sneers at all our little knowledge, yet in the scale of intellectual development I am bound to place him high above those animals, and am hurt to allude to them, even by way of simile.

I must plead guilty to not having read Mr. Stride's letters very attentively; but for the sake of the author of them, were a thought in them worth considering, I should be most happy to do it justice, but I cannot recollect one, scientific or otherwise, that requires any serious remark. In his first letter he thought he had found out something about stratified granite, and it was this mistake that led him into the mess. In the second he was great upon the fumes of his cigar, and talked of Beaumont and Davy as his chief consolation in sickness; and I think he likened his brain to a high-pressure steam-engine, but made no lucid statement. No doubt this was excusable, as it was immediately after Christmas, but I thought of finding something tangible in his latter effusions. I regret to say, however, that I am disappointed. All is very, very vague and common place—hints at my carrying a dictionary, charging me with not being acquainted with the great authors, and a few other things—showing immoderate vanity and self-conceit, which it is almost a pity to point out, as he must feel great happiness in being on such good terms with himself, but no doubt he is not very sensitive. His chief aim seems to be to deprive me of a corner of the mantle of the *Mining Journal*, which has covered a thousand faults in a thousand miners and writers, and which he uses evidently to form a popularity for his new Mining Dictionary, notwithstanding he looks down with ineffable contempt upon the parties for whom this wonderful production is designed; and apparently all this because one of our fraternity gave him a cigar—(for he is great in his knowledge of tobacco, notwithstanding he cannot understand the chemistry of its combustion)—not marked "Habana de Cuba." Why did Mr. Stride fly at us so fiercely? It is a dangerous practice, and leads to unseemly results. I have myself witnessed the rushing out of a cur from some dark passage on a mastiff or a bulldog, which he took for smaller game, and on finding his mistake he had to return a sadder if not a wiser dog. The moral will be clear to your readers, but I fear not to Mr. Stride, who is somewhat pachydermatous in his nature.—*Great Winchester-street, Feb.* 12. W. BATTYE.

[The correspondence on this subject must now terminate.]

LEAD MINING IN SPAIN.

Mr. J. Lee Thomas, late superintendent of Las Infantas Mines, has just completed some interesting "Notes on the Lead Mining District of Linares,"* made during a three years' residence therein. The town of Linares is situate near the centre of the province of Jaen, at about two leagues' distance from the royal road from Seville to Madrid; it is surrounded on all sides by mountains. It is difficult to define the boundary-line of the Linares mining district, but it is generally considered to comprise the mines in the vicinities of Vilches, Banos, and Bailen, and to cover a superficial area of about 130 square miles. It must not, however, be assumed that metalliferous veins are not found beyond these boundaries, or that the metal-bearing rock is comprised within them. To the north are the silver-lead mines of La Carolina, Arquillos, and the Sierra Morena, some of which are exceedingly rich in silver, and well worthy of attention; and the Sierras of Cazorla and Andujar also abound in unworked veins of lead, copper and antimony. The Government sett of Arayanez, to the north of Linares, is 8000 varas long and 1000 varas wide, embracing nearly all that is known of the Arayanez lode. Of these 8000 varas the lode is worked upon almost uninterruptedly for 5000. It has been worked in some places to the depth of 280 varas, where the records existing in the Government archives speak of it as extremely rich. The average depth of workings is not more than 50 fms., the greater part of these being above adit level: the country through which the lode passes is granite, and the vein is found most productive where the granite is soft. Following the direction of the workings on the Arayanez lode, in a north-east direction, in the clay-slate formation, are the mines of Palazuelos; they have been worked very extensively, and the lode, to all appearance, is a very powerful one—sulphate of barytes is very abundant. Nothing of any certainty is known as to their previous explorers, but the remains of ancient edifices prove them to have been capitalists.

A chronological history of the working on the Arayanez lode comprises nearly all that is known of the history of the district. It appears from the archives in the office of the district that previous to the year 1748 the right to explore the mines was public; but subject to the payment of a Government tax of 10 per cent., on the ore raised, or 5 per cent. on the lead produced, if the ore was smelted. This tax of 10 per cent. on ore and 5 per cent. on lead, first imposed in 1706, was, in conformity with the system of Spanish finance, farmed by the State to the highest bidder, the State reserving to itself the right to purchase the lead ore and lead at such prices as the State should fix. On these terms capitalists would not risk their money in working the mines; they were, consequently, at this period in the hands of those whose capital consisted in their own labour, and whose necessity prevented them from following out consistently any system of working, or from making use of machinery to economise labour or overcome natural difficulties. The consequences of this are apparent in the numerous shafts, or rather holes, dotting the whole district (of a size sufficiently large to admit of the descent of the miner), which have, in most cases, been carried down to water-level, and then necessarily abandoned. The result of this method of procedure on the part of the Government at length made itself so apparent, by the supply falling short of the demand, that the attention of the Government was called to the subject, and they appointed Don Pedro Nunez de Quiros to report to them. He stated that the mines were as capable of production as ever, but that the miners who worked them had no capital to invest in permanent works. In consequence of this report the Government determined to become themselves adventurers, and to work the mines for account of the State, instructing Don Quiros to call together the most experienced miners of the immediate district and consult with them as to which mine they ought to select, the system they ought to pursue, and the works they ought to undertake. The appointed meeting took place, and, after some discussion, in which the mines of La Cruz, Pozo Ancho, and Los Alamillos, had their supporters, the majority decided upon Los Arayanez, both on account of its greater richness and the advantages which the ground offered for draining the mine.

The State having thus reserved to itself the right to work the mines of Linares, in 1749 commenced operations in Los Arayanez, suspending the works in the other mines of the district; in 1750 they replaced Don Quiros by Dr. Carlos Lancy, who, in his report to the Government the same year, says that the mines of Arayanez offered an inexhaustible supply of riches. Bowles, the geologist, who visited Linares in 1752, speaking of a particular branch worked before his arrival, says that he does not recollect the number of quintals extracted, but asserts, without fear of contradiction, that one branch produced more lead than is raised from the mines of Freibourg in Saxony and those of Clausthal in the Hartz in twelve years. In 1760, the mines were visited by Dr. Enrique Storr, manager of the Almaden Mines, who complained in his report of the unminerlike way in which operations were conducted—among other things, that the small ore was allowed to remain in the stopes and that the round ore only was brought to surface. In 1762, the Government, through the agency of Bowles, contracted with a German mining engineer, Juan Vuger, and fourteen miners, who were employed in timbering the mine; and in 1764 Don Manuel de Anlatia proposed to the Government the unwatering of the mine, by a machine to be worked by two old men; leaden tubes were fixed, and the machine erected, but it was found to require 44 young men instead of two old ones, and was abandoned in 1766. In consequence of the ill success of this machine, affairs assumed rather a gloomy aspect, and it was again proposed to abandon the mine. At this juncture a practical miner, Don Fernando Delgado Pajares, offered to contract for the extraction of ore; his proposition was accepted, and he continued with the contract for 19 years—from 1766 to 1785—during which time he extracted 3,303,720 arobas, or about 35,270 tons, of ore, at prices varying from 1*l.* 6*s.* to 3*l.* 10*s.* for large ore, and from 13*s.* to 1*l.* 13*s.* for small ore. This practice of paying for the small ore only half the price of round could hardly have been carried into execution in any mine less rich than Arayanez; and there is every reason to believe, from a comparison of the quantities of each class extracted, that no other than round ore was drawn to surface, and that the small ore delivered into the stores was that detached in the process of dressing the round ore subsequent to its arrival at surface. In 1780, it appears, that in a part of the mine which had reached a depth of 900 varas (92 fms.), and where great riches had been met with, the contractors complained that they could not continue raising ore at the Government prices. It appeared, from their petition, that out of 536 men employed in this section 398 were engaged in the hauling of water and stuff, and in removing the ore and ground broken from one winze to another, in espuertas or baskets; and that of the 538 only 80 were miners. In Dec. 1780 this part was abandoned, and nothing has since been done. The history of this mine from this period to 1825, when the State again gave the public permission to work the adjoining mines, possesses but little interest. The total produce of the mine, in ore, from 1748 to 1858, is officially stated at 22,961,000 arobas (260,921 tons). During the author's residence at Linares they were considering a proposition of their engineer to erect a whim on the sett; but it appears that the Government would not consent to so reckless an expenditure as 50*l.* in fixed plant! The idea is really ludicrous—a sett of nearly four miles in extent, which has produced ore to the value of nearly 3,000,000*l.*, the workings of which have been left almost uniformly rich, and *without a whim!* The mine, however, is nearly a virgin one, and by a recent law for the sale of State property will, with other State mines—excepting only Almaden—be brought to the hammer, and will then, it is hoped, then fall into good hands.

Mr. Thomas then particularises the several mines of the district, and discusses the capabilities of Linares as a mining district. The entire work affords absolute proof of the abilities of the writer, and cannot fail to be interesting to all connected with mining, but will be more especially so to the shareholders in the Linares, San Fernando and other companies in the district worked with English capital.

* London: Effingham Wilson, Royal Exchange.

THE GOLD FIELDS OF THE COLONY OF VICTORIA.—No. II.

BY EVAN HOPKINS, C.E., F.G.S.

In my letter from Melbourne of July 29, 1852, to the Port Phillip Gold Company, I made the following observations:—

The board must consider well the real state of the colony. The sudden discovery of gold has placed the local Government in a very awkward position. The Government has been compelled to allow the mob of all nations to come and go to the diggings, and driven by precedent and necessity to adopt the petty license system to secure the rights of the Crown to the precious metal, and obtain something like a revenue in lieu of the royalty. Whilst the gold scrambling is going on, the Government cannot safely alter these temporary regulations. The executive can only modify them gradually, and we must act and proceed in our operations accordingly. As far as I have been able to judge from a survey in the neighbourhood of Mount Alexander, from Fryer's Creek to Bendigo, the gold scramblers will soon disappear, and we shall have the refuse to ourselves.

In this I was mistaken: although the diggings of Fryer's Creek, Forest Creek, and Bendigo, became comparatively exhausted in two years, and almost deserted, yet there has been such a continuous fight for existence amongst the new arrivals, that they have been compelled to return in groups, and re-wash the refuse of the old gold fields many times over to obtain a living. Thus, the quantity of gold is kept up by the increase of diggers, and great sacrifice of manual labour, the average product not being half the amount per head of that paid for breaking stones on the roads of the colony. The letter continued—

Should our mining force (on their arrival in the colony) be influenced by the exciting news from the diggings to leave our employ, I shall place no obstacles in their way. Indeed, under the present exciting circumstances of the colony, it is far preferable to have a few well-selected—say half a dozen—men of business and energy, and send them here with power, and *real* means—say 50,000*l.*, than to send such a large number of unavailable individuals, and machinery which cannot possibly be rendered of any advantage to the company for some time to come. As regards the crushing-machines, they may be required by-and-bye, but up to the present moment no quartz veins have been discovered sufficiently rich and extensive to warrant large outlays. Our field operations will, therefore, be confined (if we can obtain grants) to the extraction of the free gold from the debris, which we can separate with the greatest facility by means of our washing and extracting machines.

In my letter of August 6, 1852—

I shall only employ those who understand, and attend to, their business properly, as I am determined, notwithstanding the present state of things, to establish the company in such a manner as will ensure success. If we cannot, no body else can. There are no gold quartz veins yet found; nor do I see any prospect of discovering any worthy of *mining*. The gold is principally found in a free state, mixed with the debris of the slate and quartz. Had it not been for the full power I received from the board (on my departure from London) to establish the company's operations, the whole affair would end, like the other companies, in merely sending persons here at the company's expense, without being able to carry their object into into effect. The ordinary instructions from home, according to the common routine of mining, even to men acquainted with such business, are of no avail here, and can only tend to embarrass and prevent anything being done. It must be borne in mind that there is equal to eight months time between this and England to and fro; and when we consider that the state of the gold fields is as changeable as the clouds, and the money market and the price of gold as fluctuating as the masses—months, and even weeks, make great differences, I must have the full power to secure the position of the company in such a manner as *I* may deem most available.

THE SUNBEAM.—Mr. Robert Hunt, who has distinguished himself by his investigations of the chemical properties of light, delivered a lecture at the Russell Institution "On the Physics of a Sunbeam." The luminous body of the sun and the spots on its disc were in the first place considered. The prevalent opinion of scientific men at the present day was stated to be that the solid body of the sun was the source of heat, that it is surrounded by denser clouds, from which the chemical rays proceed, and beyond that there is an atmosphere which emits luminous rays—the spots on the sun, being immense openings in the dense clouds and the luminous atmosphere through which the body of the sun is seen. It was remarked by Sir William Herschel that there was a curious relation between the spots of the sun and the price of corn—corn being cheap when the spots we numerous, and dear when they were few in number. Absurd as such an opinion appears to be, it has been confirmed by recent scientific investigations, for the heat is greatest in those years when the spots are most abundant. The decomposition of a ray of white light by a glass prism, into the three primary colours—red, yellow, and blue—indicates only a portion of the compound nature of a sunbeam, and the proof that its heating power and its chemical power are distinct from its luminosity, may be readily obtained. If, for instance, a small hole be made in the shutter of a darkened room, through which hole a ray of the sun's light enters, and it is decomposed by a prism, the three colours will exert very different powers. A piece of photographic paper placed in the yellow rays will remain unchanged, but it will be quickly blackened in the blue, and even beyond the point where no light is visible. But a thermometer will indicate that the heating power of the spectrum is greatest in the red light, diminished in the yellow, and is least powerful where the chemical rays are most active. The same effect is produced by placing pieces of different coloured glass in the sunbeam. When the ray passes through yellow glass, coloured by oxide of silver, no chemical effect whatever is produced; when it passes through blue glass the energy of the chemical rays is increased, and the heating power is almost absorbed, whilst a film of obsidian obstructs all the light, but the heat passes through almost undiminished. Mr. Hunt mentioned some recent experiments by Lord Brougham on the sunbeam, in which, by placing the edge of a sharp knife just within the limit of the light the ray was inflected from its previous direction, and coloured red; and then when another knife was placed on the opposite side it was deflected, and the colour was blue. These experiments, Mr. Hunt said, seemed to confirm Sir I. Newton's theory, that light is a fluid emitted from the sun. The different influences of the coloured rays on vegetation and on life were then noticed. Seeds will not begin to vegetate in light, and having vegetated, plants will not grow without yellow light, and will not fructify without an abundance of blue rays. It has been ascertained that the different properties of light are diffused in spring, summer, and autumn in the proportions best calculated to produce those different effects. Mr. Hunt alluded to the popular error that plants give out carbonic acid in the night, and are, therefore injurious in bed-rooms; he said that at all times plants absorb carbonic acid, and give out oxygen, though in the night the process is conducted much more slowly.

"THE SIMPLICITY OF THE CREATION."—Under this title Mr. William Adolph has published a concise view of his new theory of the solar system, thunderstorms, waterspouts, &c., which is certainly one of the most remarkable productions that could well be imagined. He considers that the whole creation, in its immeasurable expanse, is filled with positive electricity; that every solar system has its own solar atmosphere, in which its planets move in regular and undeviable orbits; and that the positive electricity accumulates round all heavenly bodies, particularly round suns, where it shows itself as a burning body—an electric light. By this accumulation solar systems repel each other like electrified pithballs. All the planets are attracted by the suns, in whose system they revolve forward, and the moons are attracted by the planets, in whose sphere they float. The heavenly bodies, including the solid bodies of the suns, are filled with negative electricity, according to size, &c. The shell of our earth holds the electric element in bond, its endeavours to burst the walls of its prison being manifested by earthquakes, shocks, and volcanic eruptions. The sun warms the earth and planets, and by this means the non-conducting air is warmed and expanded, the earth perspires, and negative electricity is liberated, and by the aid of conductors—grass, shrubs, trees, mountains, &c.—rises into the upper air, causing, by the combination of negative and positive electricity, lightning, waterspouts, the Aurora Borealis, &c. The fire-veil of the sun is formed in the same way. The rotation of the planets is caused by the sun shining on one-half, and disturbing the equilibrium of the electricity within. The axis of the earth, like the axes of the planets, is horizontal, and at the equinox perfectly parallel with the equally horizontal axis of the sun. Attraction and repulsion causes the seasons. The moon, if ever she was a planet, which he does not believe, presents the appearance of an exhausted one; the crust which confined the electric element is cracked and rent asunder, which accounts for her floating round the earth like a ship, instead of rotating on her axis. The details of the new theory are in progress of arrangement for publication, and will, no doubt, be interesting to Messrs. Jelinger Symons, Evan Hopkins, and John von Gumpach, and the other advocates of the non-rotation of the moon; but we believe that but few who have attended a single course of lectures on mathematics at any college in the world would coincide with the author in his new theory. The extraordinary character of the statements put forth compels us to remark that we must decline to admit any controversy upon the subject in our Journal, as no benefit could result to science from discussion with the supporters of such an opinion; whilst the style of composition is of so plausible a nature as to be absolutely dangerous to those possessing but an imperfect acquaintance with science.

EXPLOSION OF GAS IN A SHIP.—Francis Maese was killed, and three other seamen badly injured, by an explosion of gas coal on board the *Prince Phillipe*, of Ostend, as she was leaving the Tyne for Trieste on Friday. The coals, which were of a very fiery nature, had been wrought in the low seam of the Felling pit, 1000 ft. below surface, where the men work with the Davy lamps. The coals had been sent direct from the pit to the vessel, and, as the hatches had been put down immediately after the cargo had been taken aboard, light carburetted hydrogen had been rapidly evolved, which had fired, as soon as the mate went below with a light, with all the force of gunpowder. The jury, in returning a verdict that the death of the seaman had been caused by the explosion, expressed an opinion that vessels taking this class of coals should be provided with ventilators, by which the recurrence of such casualties would be prevented.

TESTING MACHINES.—At the Institution of Civil Engineers, on Tuesday, a very interesting paper was read "On Chain Cable and Timber Testing Machines," by Mr. T. Dunn, Assoc. Inst. C.E. The hydraulic press machines, for testing chain cable, had been generally so costly in construction, and required such very expensive foundations, that few of the chain manufacturers had on their premises any means of testing their chains. Messrs. Dunn, Hattersley, and Co., of the Windsor-bridge Iron-Works, Manchester, having had their attention directed to this want, designed the simplified testing machine, the description of which formed the subject of the paper, and which could be produced for 200*l.* to 300*l.*, instead of 1100*l.* to 1600*l.*, the cost of the Government corporation testing machines. The bed of the new machine consisted of a trough of cast-iron, with a slot throughout its length (30 yards), to contain the portion of cable under proof; this proof was laid on guntrees of wood as a foundation, and a few cross bars were placed over the slot, to prevent the end of the chain from rising, in case of fracture. This arrangement precluded the possibility of accident to the workmen when testing chains, as the ends were retained within the trough instead of sweeping across laterally, as frequently occurred when the chains were laid upon a bench for testing. The arrangements for the main hydraulic cylinder, the valves, and the levers, were very simple and effective, and the result of very numerous series of experiments, which were given, demonstrated the power and uniform action of these machines—one of which was used at the Paris Universal Exhibition in 1855, for making a long series of experiments on the strengths of colonial and other timber, under the direction of Captain Fowke, R.E., part of whose report was quoted. The paper was illustrated by numerous drawings, and some of the links broken in testing were exhibited. In the course of the discussion it was remarked, that the broken links showed, in almost every instance, that the fractures had arisen from an imperfect union of the iron of the links in welding. It was considered that sufficient force and rapidity of blows could not be obtained by hand labour, and that tilt hammers with the requisite speed had not yet been employed; neither had steam hammers, which were merely lifted by steam and fell by their own gravity, sufficient speed for heavy chain making. A description was given of Naylor's single, or double-acting steam hammer, which could be changed at pleasure, by merely moving a lever, and by which any amount of steam, from a mere breathing upon the piston, to that of the full pressure of the boiler could be applied, and be varied whilst the hammer was in full work. Two of these hammers were employed in the workshops of the Eastern Counties Railway at Stratford, and one at Norwich. They were somewhat like the "Nasmyth" hammer, but comprised several modifications having reference particularly to the valves and valve gearing. The hammers weighed 10 cwts. each, and when worked with a length of stroke of 12 inches, and double-acting, 250 blows per minute could be obtained, or more than twice the number that could be given by an ordinary hammer lifted by steam, and falling by its own unaided gravity. The same principle was said to be applicable for riveting iron plates for shipbuilding—also for boilers, tanks, wrought-iron bridges, rivet making, &c.

IRON.—The use of this metal is of high antiquity, though not so remote, there is reason to believe, as that of silver, gold, or copper. The inferior brilliancy of its colour may, perhaps, in some degree, account for this circumstance, as well as the greater skill required to obtain it from its ores, and convert it to the purposes of art. It is mentioned frequently in the Pentateuch, and was, in the time of the celebrated writer of that history, employed for the fabrication of swords and various other sharp-edged instruments. We may form some estimate of the value that was then attached to it, from an expression in the 8th chap. of Deuteronomy, where Moses tells the Israelites, in his descriptive eulogy of the land of promise, that it is a land whose stones are iron, and out of whose hills they may dig brass. A circumstance illustrative of the same fact, at a later period, is furnished about 400 years subsequently, when Achilles proposed a ball of iron, as one of the prizes to be distributed at the games instituted in honour of Patroclus. The art of working, appears in the course of a few succeeding centuries, to have arrived at considerable perfection; for, according to the information of Herodotus, a saucer of the metal, very curiously inlaid, was presented by Alyattes, King of Lydia, to the Delphic oracle, which, he says, is of surprising workmanship, and as worthy of observation as any of the offerings preserved at Delphi. The durability of iron, and its indispensable assistance in the preparation of every other metal, make it one of the most valuable possessions that has been bequeathed to the use of civilised man. "Without it," observes Fomeroy, "agriculture could not have existed, nor could the plough have rendered the earth fertile." The philosopher, while he studies the progress of the human understanding, and compares the fortune and state of the different nations established in various portions of the surface of the globe, will remark that their iron-works seem in some measure to be proportioned to their intelligence, to the advancement of reason amongst them, and the degree of perfection to which the arts have arrived. When we consider it in this point of view, as the agent by which men, in the variety of its uses, and the numerous wants it supplies, acquire enjoyments which would be unknown to them, if they did not possess these products of their industry; iron must singularly contribute to extend their ideas, to multiply their knowledge, and to conduct their spirit towards that perfectibility which Nature has given no less as the character of the human species, than as the source of all the advantages it can enjoy. Iron is a malleable and ductile metal of a bluish-white colour, is susceptible of a very high polish, and of the specific gravity, according to the tables of Muschenbroeck, Swedenburg, and Brisson, of 7·600 to 7·895, and even 8·166 It is soluble in most acids, and precipitable from its combination with them by various re-agents, which will be hereafter pointed out. With the prussic acid it forms that beautiful pigment known in commerce and the arts by the name of Prussian blue; and in a variety of other ways constitutes the bases of many valuable preparations.—DR. REES.

THE METAL TRADES.—A very useful Chart, prepared by Mr. Johnston, metal merchant, of Glasgow, is now ready: it contains, amongst other information of the greatest interest to all connected with the metal trades, an elaborate diagram, showing at one view the prices of the principal metals during the past 16 years, the Birmingham wire and metal gauges and the modern Belgian zinc gauge, the weight and thickness of lead piping of various diameters, &c., thus forming a valuable work of reference for the counting-house of the iron merchant or broker. Copies may be had at the office of the *Mining Journal*. Price: Mounted, on rollers, 21s.; on plain sheet, 15s.

PERPETUAL MOTION.—Mr. Th. Scheller, painter, of Waedenschweyl, Swiss Confederation, has provisionally specified certain improvements in obtaining and applying motive-power. Two shafts or spindles free to revolve in suitable bearings are employed, one being in a vertical and the other in an inclined position. On the upright shaft mount a pinion which gears into the teeth of a weighted toothed wheel or disc mounted on the inclined shaft. On the toothed disc and near its periphery are four weights working in guides, the two opposite weights of each pare being connected together. Over the pinion on the vertical shaft mount a wheel of larger diameter than the pinion, which on coming in contract with one of the weights on the disc forces the weight back, and thereby pushes up the opposite weight connected to it, thus altering the centre of gravity of the weighted disc, which in endeavouring to recover its equilibrium makes a portion of a revolution, and so brings the next weight in contact with the wheel on the vertical shaft, which forces this weight back in like manner as before, pushes the opposite corresponding weight up, so that the weighted disc again revolves, brings the next weight up to the wheel, and so on. The vertical shaft has a fly-wheel mounted on it, and power to drive machinery or otherwise is derived from this shaft.

RAILWAY PERMANENT WAY.—Mr. Wm. Humber, Dowgate-hill, City, proposes to secure rails in or to chairs by wedges or keys, fitting or sliding in the longitudinal direction of the rails, the intention being to obviate the objection ordinarily attendant upon the use of wooden wedges, which are wont occasionally to become loose owing to the passage (through the chair) which is intended to receive the rail, and the wedge being made with a diminishing or tapering width in one direction only—from one side of the chair towards the other, and one wedge only being employed, without any efficient contrivance for maintaining it securely in its seat. The invention consists in manufacturing chairs with the passage (intended to receive the rail and the apparatus for fixing it) gradually diminished or tapered in two directions—from the middle of the chair towards its two opposite sides, the passage being, as heretofore, entirely on one side of the rail when fitted in the chair;—also in manufacturing metallic wedges or keys, which may be used with the improved chairs, and in securing rails within such chairs by a pair of the said wedges (to each chair) distended, separated, forced apart, or drawn away from each other in opposite directions by means of one or more distending wedges, keys, bolts, or other means of forcing or drawing them into their seats and there maintaining them, so as to prevent their becoming loose;—also, in fishing or connecting together the contiguous ends of two rails, resting in or upon two of the improved chairs respectively, by means of a fishing plate on one side of the rails, having a wedge formed at either end, inclined in the same manner as above mentioned, and fitting into each chair respectively, and the plate being bolted or secured to one or both of the rails, a fishing plate on the opposite side of the rails being either employed, or not employed, as may be preferred. Mr. Humber also secures rails in his improved chairs, or in any other chairs, by wooden wedges or keys, having bolts, rods, or straps passing through them in the longitudinal direction of the rails, whereby they may be held and maintained firmly in their intended position.

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